IS 3913 (2005): Suspended sediment load samplers [WRD 1: Hydrometry]

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निलंबित अवसाव भार सैम्पलर — विशिष्टि

(पहला पुनरीक्षण)

Indian Standard

SUSPENDED SEDIMENT LOAD SAMPLERS — SPECIFICATION

(First Revision)

ICS 17.120.20

BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Hydrometry Sectional Committee had been approved by the Water Resources Division Council.

Silt, sand, gravel and other insoluble materials transported by the streams as suspended load, bed load and wash load present problems of vital importance with regard to successful operation of many projects concerning flood control, soil conservation, irrigation, navigation, water-power development, etc. Therefore, to have adequate knowledge of the sediment load movement, a systematic sampling of the sediment at regular sampling station is highly desirable.

Since the sampling conditions encountered in streams vary widely, different types of samplers varying widely in their design, principles of working and utility in the direct estimation of the relevant type of sediment load are used. Factors such as cost, availability and specific requirements of the sampling also influence the choice of the sampler to a great extent. Annex A summarizing the characteristics of most samplers in use will help in the selection of the samplers in the given conditions. As the data obtained are affected by the sampling action and the mechanism of the sampler, any change in the sampler would itself introduce a variable. Therefore, the result obtained from different samplers may not be comparable to one another.

Suspended sediment load samplers are used for collection and estimation of the quantity of suspended materials, which remain in suspension for considerable periods of time and move with almost the same velocity as the stream.

This standard was first published in 1966. In this revision, apart from including the characteristics of various types of suspended load samplers, construction details and requirements for the satisfactory operation of bottle type sampler, which is most commonly used in India, have been brought in the main text of the standard. However, on the basis of the results of field experiments relating to the efficiency of the bottle sampler, a 'correction factor' has been introduced in this standard.

Further, in preparing this standard considerable assistance, particularly relating to the characteristics of suspended load samplers, has been derived from ISO 3716 'Liquid flow measurement in open channels — Functional requirements and characteristics of suspended sediment load samplers'.

The composition of the committee responsible for the formulation of this standard is given at Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SUSPENDED SEDIMENT LOAD SAMPLERS — SPECIFICATION

(First Revision)

1 SCOPE

This standard deals with the functional requirements, general description, performance tests and material used for suspended sediment load samplers. It also covers details of bottle type sediment sampler, normally used in India.

2 REFERENCES

The standards listed below contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below:

IS No.	*Title*
292 : 1983	Specification for leaded brass ingots and castings (*second revision*)
410 : 1977	Cold rolled brass sheet, strip and foil (*third revision*)
1068 : 1993	Electroplated coatings of nickel plus chromium and copper plus nickel plus chromium (*third revision*)
1239 (Part 1) : 1990	Mild steel tubes, tubulars and other wrought steel fitting — Specification: Part 1 Mild steel tubes (*fifth revision*)
1572 : 1986	Specification for electroplated coatings of zinc on iron and steel (*second revision*)
4588 : 1986	Specification for rubber, raw, natural (*third revision*)

3 TYPES OF SAMPLERS

Several types of samplers have been developed to cater to various functional requirements. These samplers may be grouped as follows:

a) Vertical pipe,

b) Instantaneous horizontal or vertical type,

c) Bottle type,

d) Depth integrating type,

e) Point integrating type, and

f) Pump type.

4 FUNCTIONAL REQUIREMENTS

The design of the suspended sediment load sampler should be based on the following main technical requirements:

a) Sampler should be streamlined so as to minimize disturbance in the sediment flow;

b) Velocity of inflow at the mouth of the sampler should be equal to the velocity of stream flow;

c) Mouth of the sampler should face the direction of current;

d) Mouth should be outside the zone of disturbance of flow set up by the body of the sampler and its operating device;

e) Filling arrangement should be smooth without causing sudden in-rush or gulping;

f) Container should be easily removed, readily capped and transported to a laboratory without loss of contents;

g) Sampler should be able to collect samples at any depth from surface to 0.3 m from the bed without disturbing or contaminating the water sediment mixture at other points while the sampler is being raised or lowered;

h) Sampler should be portable but sufficiently heavy to minimize deflection from the vertical due to current drag;

j) It should be simple in design and construction and require minimum care for maintenance and repair; and

k) Volume of the sample obtained should be sufficient for the determination of sediment concentration.

5 GENERAL DESCRIPTION AND OPERATION

5.1 Description

The suspended sediment load sampler shall consist of the following main parts:

a) Frame to hold the sampling bottle;

b) Spring cylinder and pipe;

c) Lever arrangement; and

d) Sampling bottle of capacity not less than one litre, preferably +10 cc.

5.1.1 The frame provides arrangement for housing one

litre bottle in vertical direction. It is attached to a spring cylinder (or lower pipe) and to upper pipe(s), through which a flexible metallic wire or rod is passed. At the lower end of the rod (or wire), a strong rubber cork to suit the size of the mouth of the bottle is fixed and at the upper end of the rod (or wire) a lever arrangement for raising or lowering the rubber cork is fixed. The spring fitted inside the cylinder (or lower pipe) helps in keeping the rubber cork tightly pressed against the mouth of the bottle to keep it effectively closed. Pipe pieces, each of 2 m length are joined together with threaded sockets to make the pipe of required length.

5.2 Operation

The sampler with rubber cork fitted in the mouth of the bottle, is lowered by means of the pipe to the desired sampling point. The lever is pressed for raising the cork and to open the mouth of the bottle for the requisite time determined earlier for the conditions under examination to fill the bottle with water sediment mixture. On release of the lever the cork again fits in the mouth of the bottle under the action of the spring.

6 TESTS FOR PERFORMANCE

The sampler shall satisfy the following tests:

a) It shall be able to collect undisturbed samples of the water sediment mixture both in quality and quantity, from depths up to 5 m and velocities under 4.5 m/s.

b) The deflection in the pipe due to bending while the final assembly of the sampler operates at the specified maximum depth of 5 m and velocity 4.5 m/s, shall not affect the operation and position of the sampler.

c) With the cork closing the mouth of the bottle, there shall be no leakage of sediment laden water either from or to the bottle, irrespective of the position of the bottle.

7 MATERIALS

Typical examples of materials to be used for different components are given in **7.1** to **7.5** and this does not preclude the use of alternative materials having characteristics equivalent to or superior to those specified.

7.1 Frame

Rust proof material, for example, brass conforming to IS 292.

7.2 Spring Cylinder and Pipe Extensions

Preferably of rust proof material, for example, galvanized iron pipe conforming to IS 1239 (Part 1).

7.3 Spring

Strong coiled of non-corrosive steel with cadmium plating Grade A of IS 1572.

7.4 Bottle

Non-corrosive material with sufficient rigidity, such as brass conforming to IS 410 with nickel plating in accordance with IS 1068 or glass.

7.5 Cork

Rubber for cork conforming to grade ISNR 10 of IS 4588.

8 BOTTLE TYPE SAMPLER

8.1 General

The bottle type sampler has the merits and demerits as given in **8.1.1** and **8.1.2**.

8.1.1 *Merits*

a) It is simple in design, construction and working;

b) It can be readily repaired at the spot without much difficulty;

c) It is capable of being used as a point integrating samplers;

d) Its body and sample container are separate; and

e) It can be operated by one or two observers without the help of any intricate mechanical device and up to the normal depths of water met in streams (that is, less than 5 m).

8.1.2 *Demerits*

a) It creates undesirable disturbances to the flowing water sediment mixture as it is not of streamlined shape;

b) The existence of initial pressure differential between inside and outside of the bottle results in a non-representative character of the sediment sample, the more so as the depth increases;

c) The disturbance due to the change in the direction of the flow due to vertical filling causes an error of unknown magnitude; and

d) It can not be and should not be used as depth integrating sampler.

8.2 Efficiency and Correction Factor

8.2.1 In case of medium (diameter between 0.075 mm and 0.2 mm) and coarse (diameter > 0.2 mm) fractions of suspended sediment, the efficiency varies from 84 percent near the surface to 72 percent at 0.9 flow depth. Correction factors of 1.191 near surface and 1.389 at 0.9 depth are recommended. At 0.6 depth, since the efficiency worked out to be 78 percent, a correction factor of 1.282 may be assumed.

8.2.2 For fine sediment (diameter < 0.075 mm), the

efficiency of bottle sampler at all depths was observed as 93 percent, giving multiplying correction factor to be applied to observed suspended sediment concentration, as 1.075.

NOTE — The field experiments for calibration were made in the Yamuna river above Okhla Head Regulator and on the Ganga river at Kanpur and at Mokamah. The range of relevant parameters covered was the following:

a) Size of suspended sediment : 0.07 mm to 0.60 mm;

b) Flow velocity : 0.61 m/s to 2.34 m/s (2 ft/s to 7 ft/s);

c) Flow depth: 2.91 m to 5.49 m (9.54 ft to 18.0 ft); and

d) Sediment concentration: 0.001 cc/litre to 2.4 cc/litre.

8.3 Construction Details

8.3.1 *General*

The bottle sampler comprises the following main parts:

a) Frame,

b) Spring cylinder and pipe,

c) Lever arrangement, and

d) Sampling bottle.

The various parts and their details are shown in Fig. 1.

8.3.2 *Frame*

The frame of the bottle sampler shall consist of the following three parts:

a) Framework,

b) Base plate, and

c) Clamps.

8.3.2.1 *Framework*

The framework shall consist of 2 vertical sides (1A & 1B) each approximately 340 mm long, 30 mm wide and 7 mm thick. The lower end of each vertical side should be moulded at right angles to the horizontal notches in the base plate (*2*). A hook should be provided near the bottom of the vertical sides, which provides the means for keeping the sampler vertical. Each side shall be vertical up to approximately 165 mm height from the base, the inside distance between the two being approximately 125 mm. Both these sides shall be bent at this height to an inside distance of approximately 110 mm in a height of 25 mm. These sides shall again be vertical to a height of approximately 150 mm with an inside distance of approximately 110 mm. The two sides at the upper end should be connected with each other with an elbow plate (*3*). It shall be approximately 110 mm long, and 25 mm thick at its two sides, having a hole in the centre for 25 mm spring cylinder (*4*). The framework, elbow plate and the base plate should be moulded to form one piece of casting.

8.3.2.2 *Base plate* (*2*)

It shall be a circular plate of approximately 110 mm in diameter and 20 mm in height. It shall have horizontal extended notches moulding with the vertical sides of the framework. The base plate shall have a circular seat of approximately 100 mm diameter and 10 mm vertical height for housing the sampling bottle. The bottom of the circular seat on the inside should have circular grooves for proper resting of the bottle.

8.3.2.3 *Clamps*

There shall be two clamps (*5* and *6*), one fixed approximately at 75 mm and the other at 170 mm from the upper end of the base plate respectively, the latter (*6*) being just above the bend of the vertical sides (1A &1B). The lower clamps (*5*) shall consist of two semi-circular shaped plates (*7* and *8*) each of approximately 230 mm total length having straight ends as shown in Fig. 2, and 25 mm in width and 2.5 mm in thickness. A bolt with fly-nut (*9*) 65 mm long should be attached to one end of the semi-circular plate (*7*) through a vertical pin (*10*), around which it shall be able to freely rotate. Both ends of this plate (*7*) shall be then welded to both the vertical sides so that the bolt with fly-nut (*9*) is free to move on the outside of the left side (1A). The other plate (*8*) on one end shall have a housing notch for the bolt with fly-nut (*9*) fixed to the first clamp (*7*) and on the other end should be attached to the right side (1B) of the vertical frame through a vertical pin *(11)* so that this plate (*8*) which is welded with the side (1B) can have a free movement round the pin (*11*). The whole arrangement have been detailed in Fig. 1. The function of the lower clamp (*5*) is to keep the bottle in position.

Whenever the bottle is to be placed or removed, semi-circular (*8*) is disengaged from the bolt (*9*) and bottle is placed or removed by rotating plate (*8*).

8.3.2.3.1 The upper clamp (*6*) shall consist of two straight pieces (*12* and *13*) approximately 110 mm long, 25 mm wide and 20 mm thick. In the centre of both of these pieces, there shall be a semi-circular hole for the neck of the bottle, so that when both these pieces (*12* and *13*) are fixed together, the neck of the bottle can fit in this circular hole. One of the pieces (*12*) should have a hole at one end through which a fly-nut headed screw (*14*) is passed. The right end of this piece (*12*) can rotate round for opening and closing, through a vertical pin (*15*) which is welded to the vertical side (1B). The other piece (*13*) shall have a threaded hole (16) in which the fly-nut headed screw (*14*) attached to the other piece (*12*) is tightened. One end of this piece (*13*) having the threaded hole (*16*) shall be welded to the left side (1A) and the other end welded to the right side (1B). The details of both these clamps (*5* and *6*) to hold the bottle (*17*) have been shown in Fig. 1. The details of fly-nut headed screw have been shown in Fig. 2.

8.3.3 *Spring Cylinder and Pipe*

8.3.3.1 *General*

The spring cylinder and pipe portion shall consist of:

a) Spring cylinder or lower pipe for housing the spring,

b) Upper pipe cylinder,

c) Rod or wire with rubber cork, and

d) Spring.

8.3.3.2 *Spring cylinder (4) or lower pipe*

It shall be made of approximately 215 mm long pipe (*4*) with 25 mm external and 19 mm internal diameter. Both the ends of this pipe should be threaded from outside. This pipe shall pass through the central hole in the elbow plate (*3*) attached to the frame. The pipe (*4*) shall be moulded or permanently fixed to the frame in such a way that an approximate length of 150 mm is protruding outside the frame. Its upper end shall be fitted with a reducing socket having approximately 40 mm as its larger diameter and 25 mm as smaller diameter. Upper pipe cylinder (*18*) with extension as required of approximately 40 mm external diameter should be attached to the reducing socket according to the requirements. A half socket (*19*) with a hole just sufficient for the rod to pass, shall be fixed to the lower end of the pipe to hold the spring (*22*) in position as shown in Fig. 1.

8.3.3.3 *Upper pipe cylinder (18)*

Separate pipe pieces of suitable lengths, for example 2 m, shall be added to the lower pipe cylinder (*4*) to make the required length of the sampler for taking measurements. The diameter of the upper pipe is increased to approximately 40 mm to enable it to be used in greater depths and higher velocities. Its top-most end shall be attached to the lever arrangement. The pipes may be graduated in units of 0.6 m from the point of measured inlet.

8.3.3.4 *Rod with rubber cork*

Just like pipe, the rod (*20*) shall be made of several portions joined together with threaded sockets according to the requirements. The lowermost portion should be approximately 600 mm long and of 12.5 mm in diameter. Its upper end shall be threaded to hold the socket for extensions. The rod extension pieces available in 2 m length have got threads on both the ends and are joined together with threaded sockets. The uppermost end of these extension rods shall be fixed to the lever arrangement.

8.3.3.4.1 A rubber cork (*21*) of approximately 40 mm in length, 35 mm in diameter at the top and 25 mm in diameter at the bottom, shall be fixed to the lower end of the lowermost rod. Details of clamp and cork have been shown in Fig. 2.

8.3.3.5 *Spring*

It shall be approximately 100 mm long, non-corrosive strong coiled (*22*) and coiled round the rod. The lower end of the spring should rest on a circular metallic washer (*23*) which in turn should rest on a small rivet (*24*) fitting tightly in a hole in the rod. The rivet shall be fixed at about 90 mm height from the lower end of the rod holding the rubber cork and held in position by the lower half socket (*19*) fixed in the lower pipe. The upper end of the spring should be held in position by two screws (*25*) fixed in the lower pipe just above the framework. These screws restrict the tension of the spring when the lever is pressed for raising the cork.

8.3.4 *Lever Arrangement*

8.3.4.1 *General*

The two principal components of lever arrangement are:

a) Flat elbow shaped plates, and

b) Lever arm.

8.3.4.2 *Flat elbow shaped plates*

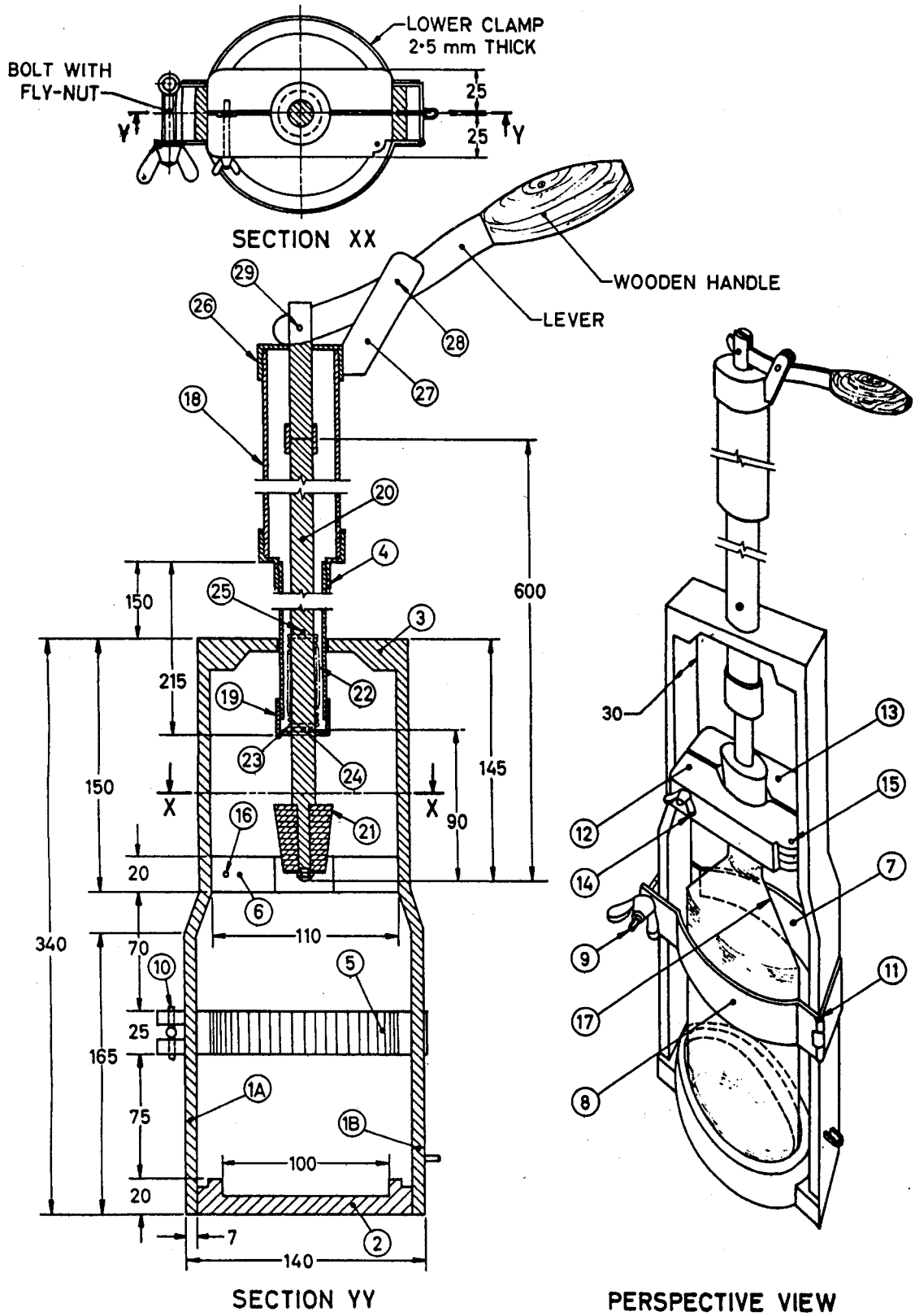
To the uppermost end of the upper pipe (*18*) a half pipe socket (*26*) of approximately 45 mm outside diameter end having a hole to suit the size of the rod shall be screwed. Both the flat elbow shaped plates (*27*) should be joined by pin (*28*) to serve as fulcrum for the lever arm and welded to the half socket as shown in the drawing.

8.3.4.3 *Lever arm*

The arm of the lever should be approximately 200 mm long and carry a wooden handle at one of its ends. This lever arm should be held between the two elbow shaped flat plates (*27*) through the pin (*28*) about which it can rotate. The other end of this lever arm should have a hole and be held between the grooves cut in the top of the uppermost portion of the rod (*20*) through a bolt (*29*) as shown in Fig. 1. Thus fixed, the lever arm shall be able to rotate round the pin (*28*) which serves as fulcrum and when it is pressed on its handle downwards, it shall raise the rod and thereby the rubber cork fixed to the other end to open the mouth of the bottle. On its release the rubber cork shall close the mouth of the bottle again under spring power. The details of lever arm are shown in Fig. 3.

8.3.5 *Sampling Bottle*

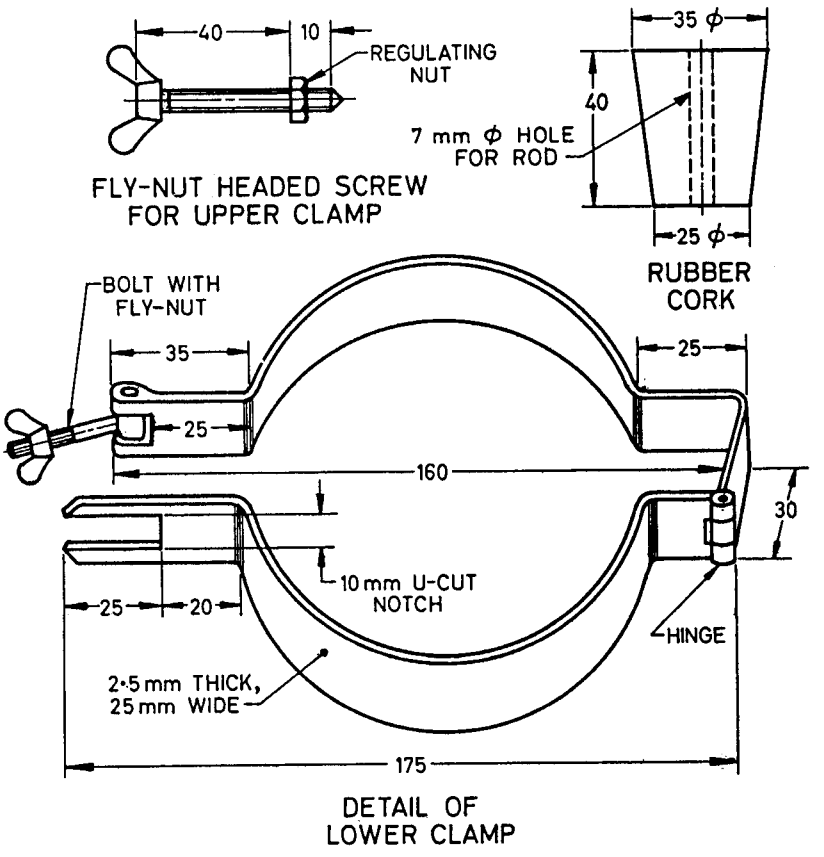
8.3.5.1 It shall be a standard 1 litre bottle preferably of glass of suitable thickness to ensure rigidity, alternatively a 0.71 mm (22 gauge) thick brass sheet, nickel plated and smoothly finished both inside and outside may be used instead of glass.



NOTE — Part Numbers are given inside circles.

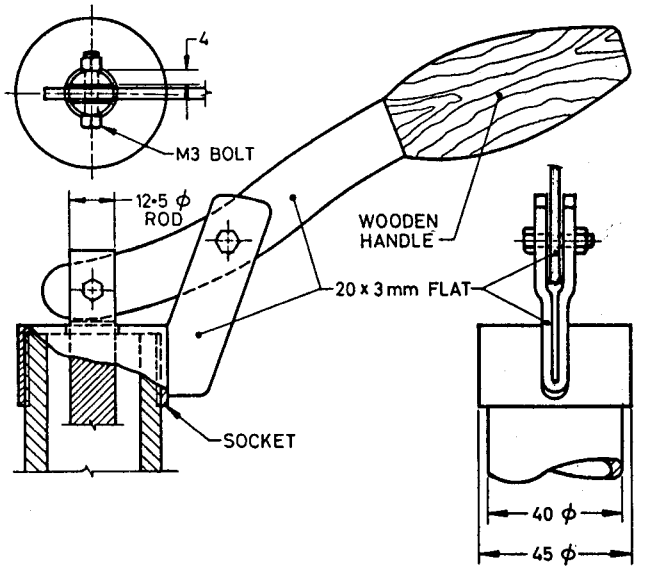
All dimensions in millimetres and approximate.

FIG. 1 BOTTLE TYPE SAMPLER



All dimensions in millimetres.

FIG. 2 DETAILS OF CLAMP AND CORK



All dimensions in millimetres.

FIG. 3 TYPICAL DETAIL OF LEVER ARRANGEMENT

8.3.5.2 The mouth of the bottle should be 30 mm in diameter having a ring of 36 mm diameter made of metallic wire of 3 mm diameter so that the rubber cork shall be a tight fit in this. The bottle shall fit properly in the sampler. Its joints shall be leak proof and smoothly finished inside and outside. A tolerance of up to + 10 cc is permissible. The details are shown in Fig. 4.

8.4 Pre-requisites for Satisfactory Operation of the Bottle Sampler

8.4.1 The bottle sampler shall meet with the following requirements, for its satisfactory operation:

a) Bottle shall remain vertical during operation.

b) Bottle should not move upward with the movement of the cork, because the passageway for water sediment mixture will get reduced and it will take longer time for the bottle to fill in. Therefore, the upper fly-nut and lower bolt arrangements shall be so designed that they do not permit any upward movement of the bottle when they are fully tightened.

c) Spring in the spring cylinder shall work properly such that the cork fits exactly in the mouth of the bottle. When the spring does not work properly, it should be taken out, cleaned, oiled and refitted such that the cork fits exactly in the mouth of the bottle.

d) There shall be no leakage of water into the bottle and the lower and upper ends of the rod should be joined together at the position when the cork fits tightly in the mouth of the bottle.

e) Maximum passage of water into the bottle shall exist when the lever is in pressed condition, that is, when the upper end of the cork touches the lower end of the half socket (*19*).

f) Bottle should, however, not be completely filled up as overfilling is likely to introduce errors in the quantity and character of the sediment sample. For this purpose, the time required to fill the bottle should be obtained from preliminary observations and the lever should be pressed when the mouth of the bottle has reached the desired depth, and kept open for time slightly less than the minimum time required for complete filling, and released.

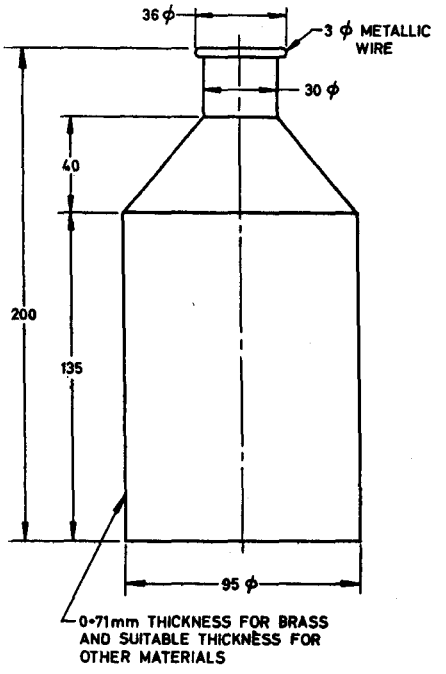
9 MARKING

Each frame shall prominently show the name of manufacturer and year of manufacture in the base plate. A certificate from a well equipped laboratory showing the details of the tests carried out, as specified in **6**, shall be made available to the purchaser on demand.

9.1 BIS Certification Marking

The product may also be marked with the Standard Mark

9.1.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. Details of conditions under which a license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.



All dimensions in millimetres.

FIG. 4 ONE-LITRE BOTTLE

ANNEX A

(Foreword)

CHARACTERISTICS OF SUSPENDED SEDIMENT LOAD SAMPLERS

Sampler No.	*Type*	*Description*	*Disturbance to Flow Characteristics*	*Intermixing of Sample with Water*	*Sampling Action*	*Field Handling*	*Adaptability to Various Field Conditions*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A1	Can or pail	Ordinary can or pail	Considerable	Considerable	Instantaneous	Not necessary to transfer the contents	Offers considerable resistance to current. Only surface samples are taken
A2	Vertical pipe	With a vertical cylinder or pipe forming the container. When the sampler is lowered to the desired depth, water sediment mixture flows upward through the container. Valves at either end close and trap the sample	Considerable	None	Instantaneous. Samples are not weighted according to velocity distribution	Necessary to transfer into another container	Offers considerable resistance to current. Not satisfactory when close to stream bed. Effective in still water or at very low velocities
A3	Instantaneous vertical	A vertical sampler with arrangement to open the sampler for the instantaneous (rapid) intake of samples at the desired time and depth	Effect not evaluated	None	Instantaneous	Necessary to transfer into another container	Not satisfactorily streamlined or adapted for use near stream bed. Effective in still water or or at very low velocities
A4	Vertical	A vertical sampler with opening arrangement for slow intake of samples at the desired time and depth	Effect not evaluated	None	Slow filling, no initial inrush	Necessary to transfer into another container	Allows sampling very close to stream bed. Effective in still water or at very low velocities
A5	Bottle	Consisting of a standards container held in a case with	Considerable	Considerable, if not opened	Bubbling or slow filling after initial	Container with sample	Not capable of sampling close to stream bed. Has high

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		a device for lowering and opening at the sampling point. The mouth is kept open for the minimum time required to fill the bottle		and closed at the sampling point	inrush	removable	efficiency in trapping fine grade sediment and the efficiency is less with the increase in grade
A6	Bottle (modified)	Consisting of a 1 litre capacity container fitted in a case with a device for lowering or raising and opening at the sampling point. Provided also with separate water intake and air exhaust device for equalizing pressure inside and outside the container	Considerable	Considerable, if not opened and closed at the sampling point	Slow filling, no initial inrush present	Container with sample detachable	Not capable of sampling close to stream bed
A7	Single-stage suspended sediment sampler (automatic)	Used for automatic collection of samples from flashy, intermittent streams at remote sites. The sampling unit consists of a bottle with an intake and an exhaust tube, each tube bent to an appropriate shape. Several sampling units are mounted one above another on a vertical support. As the water surface rises in the stream, it also rises in the intake tube of the sampler. When water reaches the crown of the intake, flow starts and the bottle fills. The sampling ceases when the water level in the bottle reaches the inner end of the air exhaust which is kept at a lower level than the inner end of the intake.	Inconsiderable	Inconsiderable	Slow-filling, no initial inrush	Container with sample removable	Not capable of sampling close to stream bed. Samples are usually obtained near the edge of the stream. No samples are taken during the falling stages. There are two types of intake, namely, vertical and horizontal. Vertical type is used for sediments finer than 62 μm and the horizontal intake is used for sediments coarser than 62 μm

ANNEX A (*Coninued*)

Sampler No.	*Type*	*Description*	*Disturbance to Flow Character-istics*	*Intermixing of Sample with Water*	*Sampling Action*	*Field Handling*	*Adaptability to Various Field Conditions*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
B1	Instantaneous horizontal	With a horizontal cylinder equipped with end valves which can be closed suddenly to trap instantaneous samples at any desired time and depth	Inconsidera-ble	Inconsidera-ble	Instantaneous	Necessary to transfer into another container	Allows sampling very close to stream bed. Adaptable to any stream or depth
B2	Point-integrating	A streamlined body with tail vanes, containing a sampling bottle designed to fill continuously at a given point over an interval of time. Therefore, it is provided with an opening and closing mechanism and also with a pressure equalizer to minimize the initial inrush of water. Many of these samplers are capable of being used as depth integrating samplers also	Inconsidera-ble	Inconsidera-ble	Smooth-filling, minimum initial inrush	Container with sample removable	
B3	Vacuum (suction developed by pump)	The sediment mixture is sucked in through a pipe or hose, the intake of which is placed at the desired sampling point. By regulating the intake velocity an undisturbed sample can be obtained.	Inconsidera-ble	None	Time-integrated	Container with sample removable	Present design not transportable. Somewhat limited in use owing to resistance to current. Heavy sediment loss in pipeline may limit the use. As there is a difference between the average concentration in the stream and that at the intake, a correction is required which varies with stage and sediment

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
B4	Intermittent pumping (automatic)	Designed for use at sites where personnel are not available to take samples manually, for example, ephemeral and flashy streams or streams in isolated locations. Samples are taken from an intake in the stream by means of a pump. Prior to sampling the intake system is flushed. The sampling frequency is controlled on the basis of stage at the installation so that samples may be collected at a certain interval during low water and at more frequent intervals during higher stages. Some models also permit sampling on a time as well as a stage basis	Inconsidera-ble	None	Smooth filling	Container with sample removable	The sampler is transportable. More efficient in trapping fine sediments. As there is a difference between the average concentration in the stream and that at the intake, a correction is required which varies with stage and sediment
B5	Depth-integrating	A streamlined body with tail vanes, containing a sampling bottle and designed to fill continuously during lowering from surface to bed (as well as on the return trip from bed to surface). These do not have an opening and closing system as in the point-integrating type. The samplers designed to fill during lowering only are provided with a foot trigger which closes both inlet and exhaust upon contact with the bed	Considerable	Inconsidera-ble	Smooth-filling. Although the sampled filament will enter the intake nozzle at an angle, provisions exist for making inlet velocity essentially equal to the local velocity of the stream	Container with sample removable	Capable of sampling close to the stream bed

NOTE

Report No. 1—Field Practice and Equipment Used in Sampling Suspended Sediment of A study of Methods Used in Measurement and Analysis of Sediment Loads in Streams - by the US Federal Inter-Agency makes a comprehensive survey of about 65 samplers that have been used in the past. This standard covers only the main types of well-known samplers without going into the details of the models.

In the instantaneous horizontal type, there are different models, for example, Elwood Mead, Collet Sampler, USA, Italian, Swiss, Tait Binkley (United Kingdom), Zukosvasky Batometer (USSR), Sind (Indian), Puri (India), Uppal (India), Leitz.

In the bottle-type samplers, there are different models, for example, earlier models of USGS, later model of USGS known as Colorado bottle samplers and the Punjab type (with local improvements, for example to indicate the condition of filling and with provision for attaching sounding weights so that the sampler can be used for greater depths). The Punjab-type sampler is widely used in India.

Under the general heading of time-integrating samplers (or which point-integrating and depth-integrating are two classifications) there are many models, for example Haigh, Anderson-Einstein, Vaccum Batometer (USSR).

In the point-integrating type, there are two varieties - the turbisonde (Neyrpic-Grenoble-France) and the US type. The turbidisonde weighs about 92 kg; it has to be used with a crane and needs a special type of cable to provide the air supply for equalizing the pressure inside the sampler with that of the outside when the sampler is immersed in the stream; it allows a remote-controlled sampling either from the surface to the stream bed or from the stream bed to the surface, continuously or only from a portion of the vertical. Sampling down to 0.12 m distance from the bottom is possible. In the US-type of samplers, there are different models- USP 43, USP 46, USP 46R, USP 50, USP61 and USP 63 - and all are suspended by means of cable and crane. These models consist of a streamlined shell with an inner recess to hold the sample container and an air chamber which are interconnected, and connected through a valve. At present, USP 50, USP 61 and USP 63 samplers are in use and they weigh 135 kg, 47 kg and 90 kg respectively. Generally, the greater the mass of the sampler, the better is the adaptability to larger depths and higher velocities; while the USP 50 can be used down to a depth of 60 m, the other two can be used down to a depth of 50 m only.

In the depth-integrating type of samplers, there are two types, namely, hand-operated - which are light in weight- and those operated by cable and crane, which are heavier. There are models such as USD 43, USDH 45, USDH 48 and USDH 59 of USA besides two Russian types - horizontal bottle sampler (wading type) and State Hydrological Institute type. Of these, USD 49, USDH 48 and USDH 59 are currently used. The USD 49 weighs about 28 kg, USDH 48 weighs 2 kg and USDH 59 weighs 10 kg. USDH 48 is operated with a wading rod and can take samples up to 0.1 m from the bed of the stream. USDH 59 is attached to a flexible suspension line and operated by hand.

ANNEX B

(Foreword)

COMMITTEE COMPOSITION

Hydrometry Sectional Committee, WRD 01

Organization	*Representative(s)*
Central Water Commission, New Delhi	SHRI M. K. SHARMA (*Chairman*)
AIMIL Private Ltd, New Delhi	SHRI S. C. JAIN SHRI K. S. SUBRAMANIAM (*Alternate*)
Bhakra Beas Management Board, Punjab	DIRECTOR (WR) SENIOR DESIGN ENGINEER (WR) (*Alternate*)
Central Water &Power Research Station, Pune	SHRI A. R. CHAVAN SHRI B. S. KULKARNI (*Alternate*)
Central Water Commission, New Delhi	SHRI S. K. SENGUPTA DIRECTOR (RD) (*Alternate*)
Consulting Engineering Services (India) Private Ltd, New Delhi	SHRI T. S. BATHIJA SHRI S. S. NARANG (*Alternate*)
Electronic Equipments, Pune	SHRI V. R. MUNAGEKAR SHRI S. R. MUNAGEKAR (*Alternate*)
Fluid Control Research Institute, Palghat (Kerala)	DR NAGARAJ SITARAM SHRI JACOB CHANDAPILLAI (*Alternate*)
Indian Institute of Science, Bangalore	DR K. SRIDHARAN
Indian Institute of Technology (Department of Civil Engineering), Roorkee	DR G. L. ASAWA
Irrigation Department, Government of Andhra Pradesh, Hyderabad	DIRECTOR (ERS)
Irrigation Department, Government of Karnataka, Bangalore	DIRECTOR (ERS)
Irrigation Department, Government of Punjab, Chandigarh	CHIEF ENGINEER (IPRI) RESEARCH OFFICER (IPRI) (*Alternate*)
Irrigation Department, Government of Uttar Pradesh, Lucknow	DIRECTOR (IRI) CHIEF ENGINEER (GANGA) (*Alternate*)
Ministry of Railways (RDSO), Lucknow	JOINT DIRECTOR (STANDARDS) DEPUTY DIRECTOR (STANDARDS) (*Alternate*)
National Hydroelectric Power Corporation Ltd, Faridabad	SHRI SHANKRACHARYA SHRI RAJIV BABOOTA (*Alternate* I) SHRI ANIL BHATNAGAR (*Alternate* II)
National Institute of Hydrology, Roorkee	DIRECTOR DR P. K. MOHAPATRA (*Alternate*)
National Physical Laboratory, New Delhi	RESEARCH OFFICER DIRECTOR (*Alternate*)
In personal capacity (*425/14 T.V. Nagar, Pune 411037, Maharashtra*)	DR S. V. CHITALE
BIS Directorate General	Director & Head (WRD) [Representing Director General (*Ex-officio*)]

Member Secretary
SHRI S. S. SETHI
Scientist 'F' (WRD), BIS

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